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THE CLIMATE OF ANCIENT PALESTINE, PART III.*

(CONCLUSION.)

BY

ELLSWORTH HUNTINGTON.

(4) WATERLESS RUINS.—The desert borders of Palestine contain scores of places where the ruins of large cities are tenanted to-day by a mere handful of squalid Arabs. The country around the ancient cities usually abounds in small ruins, which once were prosperous villages, although now they occupy regions which have almost no water supply. In addition to the remnants of cities and villages there are ancient terraces and other indications that the whole region was once thickly settled by an agricultural people. Petra, Philadelphia, Gerasa, Bosra, and Palmyra are among the best-known examples of cities whose glory has departed and whose sites are left desolate. In every one of these cities and in scores of other places the present water supply seems to be inadequate for the support of a population such as is indicated by the size and magnificence of the ruins. Nevertheless, travellers of all sorts, both scientific and unscientific, are prone to say that if the present inhabitants would bestir themselves, if they would give up their lazy habits and emulate their predecessors, and if they could be freed from the twofold curse of misgovernment on the one hand and Beduin raids on the other, the whole country might be restored to its ancient state of prosperity. They assume that natural conditions have not changed beyond remedy. Unfortunately, in most cases we have no accurate statistics upon which to base an estimate of the truth of this assumption, for in modern times no part of the country has ever enjoyed the happy

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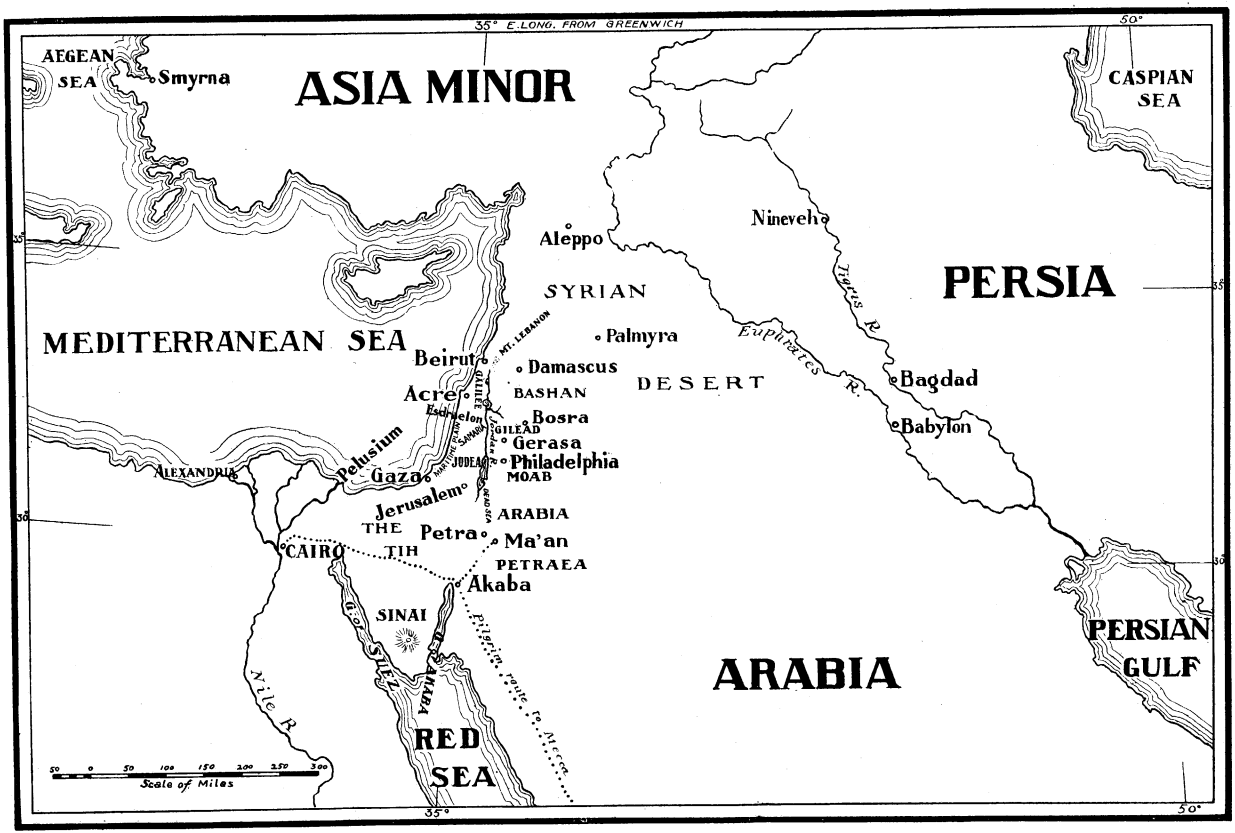
* Part II. in BULLETIN for October, p. 577.



Map of Syria and Surrounding Countries.

conditions demanded by the traveller. The best that can be done is to gather together chance bits of information and examine them as closely as possible, trusting that ere many years the whole question may be studied in detail.

It may fairly be assumed that all the ruins of Syria owe their permanent abandonment to the same cause which has occasioned the general decline of the country. Earthquakes, floods, pestilence and similar sporadic phenomena may account for the temporary desolation of certain places, but they can scarcely have caused the permanent and complete depopulation which we see throughout the borders of Syria and Palestine. Therefore, in what follows it will be assumed that the decline of the once prosperous region of eastern Syria is due to one of the two causes which have been mentioned so often, namely, human folly, which includes war, misgovernment, laziness, and ignorance, and changes in natural conditions of rainfall, temperature and the like. A single city will serve as a type of all.

PALMYRA.*—The largest, the most famous, and the most fully described of the ruined cities of eastern Syria is Palmyra. We have no certain knowledge of it until about 50 B. C., when Antony, at the instigation of Cleopatra, sent an expedition to plunder it. The inhabitants, largely merchants, took their most valuable possessions and fled across the Euphrates where they were able to repulse the Romans. For three centuries thereafter Palmyra grew in wealth until the days of Zenobia. We cannot recount here the familiar story of the gracious Arab queen, whose wonderful beauty was only equalled by her rare learning, chastity, wisdom and courage. Suffice it to say, that in her day Palmyra ruled the East from Egypt to the Bosporus; but the glory of the desert Queen and her desert city was short-lived. In 271 A. D. Palmyra was conquered by the Emperor Aurelian, who restored the sway of Rome. He did not destroy the city, but, nevertheless, it steadily declined. Its trade rapidly fell off, and the huge caravans which had formerly brought to it the wealth of India, Persia and Arabia no longer frequented its marts, but went far to the north by way of Aleppo on the border of the Syrian desert. The fall of Palmyra was like that of Petra and Bosra; and the causes were probably the same in all three cases. In the early days when Petra and Bosra were prosperous and when caravans crossed all parts of the desert, Palmyra was rich, but was only one city among many. Then when the trade of the southern cities decayed, all the commerce of the East was concentrated at Palmyra, and its wealth and luxury increased amazingly. Finally, like its predecessors, Palmyra succumbed to the influence which was driving trade and civilization northward. In the fourth and fifth centuries it recovered somewhat from the decline which had taken place at the end of the third century, and became a Roman post and an archbishopric under the Metropolitan of Damascus. In the sixth century Justinian repaired the city, which had been for some time almost deserted, restored the walls, and built an aqueduct to supply water to the garrison which he stationed there. This is the last that is known of Palmyra in Roman history. When the Mohammedans took possession of the country it was of no importance whatever, so far as can be learned. It recovered somewhat, however, during the Middle Ages, for among its ruins are those of a large mediæval castle, and Benjamin of Tudela says that when he visited it, about 1172 A.D., its population included two thousand Jewish merchants. With such a number of merchants, or even with half as many, the total population must have been at least five or ten thousand. In the days of Abulfeda, 1321 A. D., it had probably already declined, for he simply mentions its palm and fig trees and its ruined columns and temples. To-day Palmyra is a squalid village of wattled mud huts, shaped like bee-hives. It varies in size apparently. Addison (1838: II: 333) says that in 1835 it had only 12 or 15 families; Cernik (1875: 10) attributes to it a population of 800 souls; while most authors say that it has only 40 or 50 families; that is, two or three hundred people. Their wretched dwellings are clustered within the ruins of the splendid Temple of the Sun.

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* See Map accompanying Part I. in the BULLETIN for September, p. 513.

Among modern cities the one which most closely resembles ancient Palmyra is Damascus. On the whole, the modern capital of Syria appears to be smaller and less wealthy than its predecessor. The character of the two may be judged from a comparison of Pliny's description of Palmyra with the description of Damascus in "Mill's International Geography," a book which serves much the same place to the modern Englishman that Pliny's work did to the citizens of the Roman Empire. The description of Palmyra runs thus: "Palmyra is a city famous for the beauty of its site, the riches of its soil, and the delicious quality and abundance of its water. Its fields are surrounded by sands on every side, and are thus separated, as it were, by nature from the rest of the world. Though placed between the two great empires of Rome and Parthia, it still maintains its independence; never failing, at the very first moment that a rupture is threatened between them, to attract the careful attention of both."

The modern description of Damascus runs thus: "Damascus, the largest town in Syria, (is) built amidst extensive gardens, on the edge of the desert beneath Anti-Lebanon. Lines of railway connect Beirut with Damascus and a steam tramway runs from Damascus to the Hauran. Other inland transport is by mule or camel."

The two descriptions give the same general impression. The size of the two places may be judged from the following statements of Porter (1855: 137 and 239): "That portion of the ancient city [of Damascus] within the circuit of the ancient walls [built by the Romans at about the same time when the walls of Palmyra were built] is about three miles in circumference. It is densely populated throughout, with the exception of a few gardens on the south side. On the northern side of the city proper there is an extensive suburb; but by far the largest suburb lies on the south and west of the city, stretching out into the plain for about two miles. [The city's] length, from north to south, is about three miles, and its greatest breadth, a mile and a half." The circuit of the city is about nine miles, according to Porter's map and description. In regard to Palmyra, he says that the walls "are only about three miles in circumference [the same as those of Damascus], but there is sufficient evidence to show that the ancient city extended far beyond them, and probably occupied a space nearly ten miles in circumference." Evidently ancient Palmyra and modern Damascus were of about the same size, so far as area is concerned. This is made clear by the two accompanying plans (Figs. 5 and 6), which are reproduced from Porter's book, and have been reduced to approximately the same scale. The plan of Palmyra is on a slightly smaller scale than that of Damascus. It looks much smaller because the parts of the old city outside the wall are not included. If the walls of the two cities are compared, or if the grand colonnade of Palmyra be compared with the similar avenue called Straight Street in Damascus, a very fair idea will be obtained as to the relative size of the two "Queen-cities of the Desert." The greatness of the fall of Palmyra may be judged from the fact that the modern village does not fill much more than half of the Temple of the Sun which is represented by the square at the east end of the plan. Modern Damascus is estimated to have a population of about 180,000. In its days of greatness Palmyra must have had approximately the same number.

In addition to its great urban population, Palmyra apparently had a suburban population quite equal to that of Damascus. Pliny and other ancient authors speak of a number of towns which appear to have been located somewhere near it, but which are now entirely

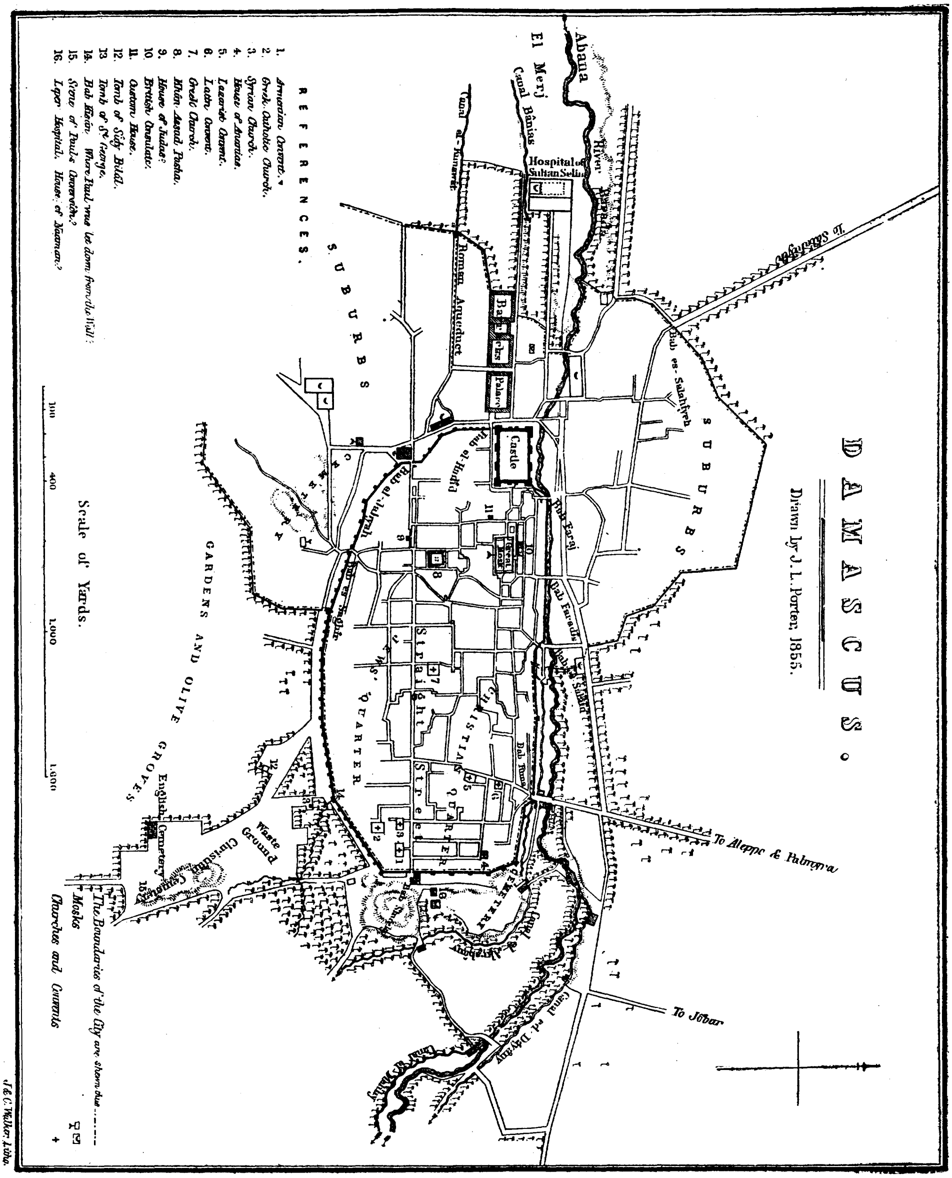
DAMASCUS.
Drawn by J. L. Porter, 1855.
REFERENCES.
1. Armenian Convent.
2. Greek Catholic Church.
3. Syrian Church.
4. House of Ananias.
5. Lazarist Convent.
6. Latin Convent.
7. Greek Church.
8. Khán Assad Pasha.
9. House of Judas?
10. British Consulate.
11. Custom House.
12. Tomb of Sidy Bilál.
13 Tomb of St. George.
14. Bab Kisán. Where Paul was let down from the Wall?
15. Scene of Paul's Conversion?
16. Leper Hospital. House of Naaman?
Scale of Yards.
100
400
1,000
1,600
The Boundaries of the City are shown thus
Mosks
Churches and Convents
Abana
River Barada
El Merj
Canal Bânias
Canal el-Kanawât
Hospital of Sultan Selim
Roman Aqueduct
Bab es-Salahîyeh
Castle
Bab el-Hadîd
Bab el-Jabiyah
Bab Faraj
Bab Farádîs
Bab es-Salâm
Bab Tûma
Bab es-Saghîr
Straight Street
Christian Quarter
Jews' Quarter
SUBURBS
SUBURBS
GARDENS AND OLIVE GROVES
Waste Ground
English Cemetery
Christian Cemetery
Cemetery
Cemetery
Canal el-Akrabâny
Canal ed-Dâîyâny
Canal Yezid
To Sâlahîyeh
To Aleppo & Palmyra
To Jôbar
J. & C. Walker Litho.

FIG. 5.

unknown. Sachau (1883: 40, 41) says that the actual city of Palmyra is much larger than is shown on any maps hitherto issued. He adds that he was told of the ruins of a city lying eight hours to the southeast of Palmyra in the waterless desert. Moritz inserts several ruins on his map in a group a few miles to the south of the city, and Ptolemy locates here the city of Aucria. It appears that the desert was at one time quite well inhabited.

In the old days Palmyra was renowned for the abundance and excellence of its springs. To-day, travellers, almost without exception, speak of the wretchedness of the water. The only permanent springs smell so strongly of sulphur that many foreigners carry water with them. The water of Palmyra is lukewarm at all seasons.

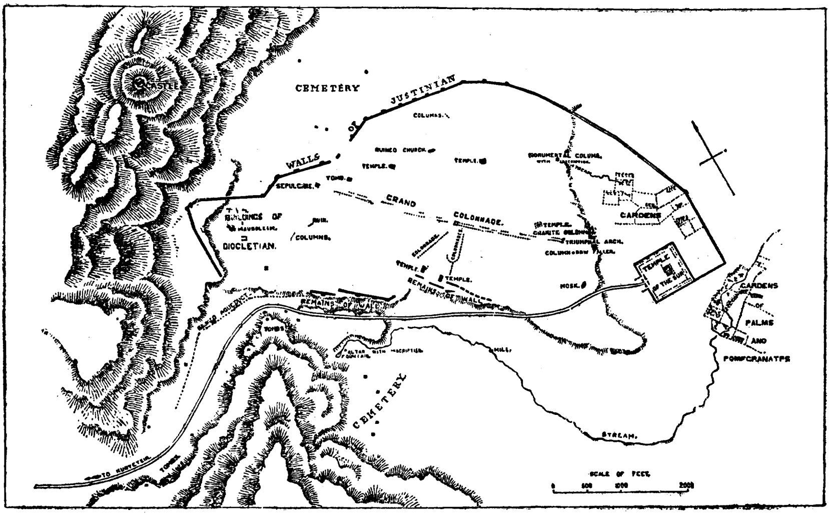

FIG. 6.—PLAN OF THE RUINS OF PALMYRA.

The main supply comes from a fair-sized fountain and serves to irrigate the palm gardens which support the present scanty population. Besides this, there is an old aqueduct which still supplies water for a few palms north of the Temple of the Sun, and another aqueduct of large size, which contains a deep pool, but does not send out any stream which can be used. The aqueduct appears to have come from a distance of five miles from Abu Fawaris northwest of the city, but there is no evidence that water was ever brought from a greater distance than this, as has sometimes been supposed.. All the way from Abu Fawaris to the city there must have been villages and gardens, according to Moritz (1889: 8), and the whole distance is dotted with circular mounds marking the mouth of wells leading down into the aqueduct. The water supply of to-day is by no means enough for the present population, although there is only one person now for from 200 to 1,000 in the past. Various travellers have found the Arabs digging vigorously in the hope of increasing the supply. In the fall of 1872, when the springs were at their lowest, Cernik (1875: 11) found no water except "a very unattractive little brooklet" [quellbächlein]; and other travellers speak of the water with similar disrespect. Yet Ptolemy says that there was in his day a "river" at Palmyra.

As to the cause of the manifest decrease in the amount of water available, there can be little doubt that man's carelessness and folly have something to do with it, but these things can scarcely explain the enormous change which is all too apparent. Neither can the change be due to earthquakes. Duhn (1894: 113) says that more or less severe movements of the earth took place in this part of the world, although not necessarily at Palmyra, in 434, 1089, and 1759 A. D. These dates seem to have no connection with the most critical periods of the history of the city. The occasional writers who appeal to earthquakes in explanation of the fall of Palmyra appear to do so merely as a makeshift to get rid of the necessity of postulating changes of climate.

The real cause of Palmyra's present sad condition seems to be lack of rainfall. In 1872 the condition of the water supply was very bad, as we have seen. In 1889 it was much better. Hill (1890) says, "All modern notices of the place which I have read refer to the fact that no fresh water is to be found there, and some express wonder at the ancient prosperity of the Palmyrenes in the absence of this requisite. The guide-books recommend the traveller to bring a supply of drinking water with him, as the stream of sulphurous water, which, till last summer, was alone known in modern times as the source of supply there is very disagreeable to the taste. We were, therefore, much surprised [in April, 1889] to find that the stream near which our tents were pitched was fresh and pure. It appears that it was only discovered in the summer of 1888, and that we were the first Europeans to see it. It runs only a few feet under the surface of the ground in an old flagged channel."—"The finding of this stream has stirred up the inhabitants to search for more fresh water, and pits were sinking in several places during our visit."

The explanation of the finding of the new supply of fresh water seems to be very simple. During the rainy season preceding the spring of 1872 the precipitation at Jerusalem amounted to 18.5 inches, during the three preceding rainy seasons it amounted to an average of 16.7 inches, and during the ten preceding seasons, to an average of 20.5 inches. During the one, three, and ten seasons preceding the spring of 1889 the precipitation amounted to 35.7, 29.2, and 27.7 inches, respectively. Throughout Syria and all western and central Asia 1872 and the preceding years were times of slight rainfall and, consequently, of famine; while 1888 was a year of abundant rainfall, and, hence, of abundant crops. When the ground became filled with water by a succession of comparatively wet years previous to 1889, the water supply at Palmyra became relatively abundant and palatable. It is reasonable to suppose that when Palmyra was one of the world's great cities there was rain enough, even in the dryest years, to keep the water supply abundant and fresh. The ability of an arid region to support population depends upon the rainfall of the dry years. If there are more people than can be supported by the diminished crops, famine overtakes the land, except where there are modern means of transportation; and part of the inhabitants of necessity die. Therefore, it seems highly probable that at the beginning of the Christian era the rainfall was always sufficient to furnish Palmyra with an amount of water much greater and of better quality than that which was found in the favourable year 1889. When the water supply decreased Palmyra must have fallen, no matter what other circumstances may have intervened. The history of the city suggests that the water supply may have become very slight five or six centuries after Christ, and then may have increased in the Middle Ages in the days of the Jewish merchants, only to diminish once more in modern times.

Conclusion. The four lines of evidence which have been discussed above may now be matched with the four climatic hypotheses set forth in the earlier pages of this article. The hypotheses, it will be remembered, are: (1) uniformity, (2) change due to deforestation, (3) progressive change, and (4) pulsatory change. The lines of evidence are: (1) the population of ancient Palestine; (2) deforestation; (3) ancient routes of invasion, migration, and trade; and (4) waterless ruins. The density of population in past times is a highly important matter, but it is not so conclusive as might be supposed, so far as changes of climate are concerned. The great number of people in Palestine in early times may possibly be compatible with the hypothesis of a uniform climate; and it is eminently compatible with those of progressive and pulsatory changes: it is certainly incompatible with the hypothesis that changes of climate have been caused by deforestation, for there cannot have been many forests where there were so many people dependent upon agriculture. The former distribution of forests suggests a change of climate, but does not prove it. The subject is chiefly important as showing that the common view as to the influence of deforestation upon the climate of Palestine is untenable. There seems to be no evidence whatever that the cutting away of forests has had any appreciable effect upon the rainfall, although it may have done harm in other ways. We may, therefore, definitely abandon the hypothesis of changes of climate due to deforestation.

In the abundant evidence as to ancient routes of invasion, migration and trade there are many facts which are inexplicable if the climatic conditions of the past were like those of the present. It is incredible that the ancient writers who describe the wanderings of the Israelites, the wars of Assyria and Egypt, and the commerce of Rome should all have falsified their accounts of desert regions. Almost without exception they speak as if the Syrian Desert, Sinai, and other arid regions were then less dry than they are now. They also describe specifically routes which were then much travelled but are now utterly impracticable. There seems to be no possibility that any human efforts within the means at the command of the ancient empires of the East could now make the centre of the Syrian Desert passable for large and numerous caravans. In view of such stubborn facts, there appears to be no choice except to discard the theory of climatic uniformity so far as Palestine and Syria are concerned.

The distribution, location and water supply of ancient ruins furnish evidence which leads to the same conclusion. Lack of space and the present dearth of detailed observations bearing directly upon the subject have made it necessary to confine our attention to a single example. In the case of Palmyra it has been suggested that the present lack of water is due to the destruction of ancient aqueducts of great extent, or to the action of earthquakes, but not one of the score or more of travellers who have described the place gives any basis for such assumptions. Nor would these assumptions explain the sulphurous character of the water to-day, or the presence of a slight amount of sweet water in times of relatively abundant rainfall. In the old days all the water appears to have been sweet, although the major part of it came from the very aqueducts which are now most strongly impregnated with sulphur. In Palmyra, as in many other places, all the facts are easily explained on the hypothesis of a change of climate; while on any other hypothesis yet proposed some fact or other remains inexplicable.

From a general review of all the main lines of evidence thus far studied it appears that there are some lines which prove unfruitful because they lead to no definite conclusion in favour of any of the four climatic hypotheses. There are others which exclude the hypotheses of uniformity and of change due to deforestation. None of the evidence conflicts with the hypotheses of progressive and of pulsatory change. A choice must therefore be made between these two. In the evidence presented in this article the only fact which bears on this point is the rapid fall of Palmyra and its later rise in the Middle Ages. This suggests a time of peculiar aridity from about the fifth or sixth to the seventh century. So far as is here set forth, however, either theory is consistent with the facts of the history of Palmyra. It is only by appealing to other regions or to lines of evidence not yet fully studied that we can settle the matter. In central Asia, Persia and the Caspian basin there appear to have been pulsatory changes of climate. The same is probably true of Palestine.

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THE SOUTHERN CAMPOS OF BRAZIL.

BY

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The few American tourists who visit Brazil usually content themselves with a stay of two or three days in Rio de Janeiro, and then continue their journey south by the next steamer for Montevideo or Buenos Aires, perhaps going ashore for a few hours at Santos, if the boat happens to stop there. Brazil is then considered as having been "done." While but little of this immense country can be easily visited, owing to the lack of railroads, yet there are parts of the southern States, not far from the ocean, which may be seen without difficulty. These districts are not only of considerable interest to-day, but are destined to be of great economic importance in the future. A recent hurried trip across the Brazilian States of São Paulo and Paraná gave an excellent opportunity to see the typical campos country, and also to inspect, under very favourable conditions, some of the most important railroad construction which is now going on in Brazil. Railroad development throughout South America is attracting more and more attention, especially in the United States, but it is difficult to obtain definite information in regard to the actual state of things without visiting the country. Reports that this or that connection has been made, or will be completed by a certain